UNITED STATES PATENT APPLICATION

FOR

BI-DIRECTIONAL SPREADER/GRADER WITH PIVOTING MOLDBOARD

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TITLE OF INVENTION: **BI-DIRECTIONAL SPREADER/GRADER WITH PIVOTING MOLDBOARD**

CROSS-REFERENCE TO RELATED APPLICATIONS

Not applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable.

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

This invention relates to the field of spreader/graders. A spreader/grader is an earth-working device attachable to a draft vehicle by a three-point hitch or other attachment means and used to perform such functions as spreading and grading dirt, gravel, or another earthen surface. Such devices commonly include a pair of parallel, spaced runners oriented in fixed relation to each other and operatively connected to the draft vehicle, with one or more blades supported between the runners.

DESCRIPTION OF THE RELATED ART

A basic spreader/grader apparatus commonly comprises a frame having two side runners for engaging an earth surface to be worked and various members for providing rigidity to the frame, a hitch for attaching the apparatus to a draft vehicle, and a plurality of transversely mounted blades for grading or otherwise working an earthen surface. Such inventions may be seen in the following United States Patents: 4,320,988 to Seal; 4,572,301 to Bourgeois; 4,924,945 to Mork; 5,332,331 to Critz; and 5,397,200 to Seal.

Various earth-working operations may require that the cutting blades of the apparatus be placed in contact with the earthen surface at various depths and at various horizontal angles and vertical angles with respect to the earthen surface. Some prior devices allow the user to angularly adjust the blades. For example, in U. S. Patent No. 4,572,301 to Bourgeois, the blades of the device are manually adjustable to angles suitable for sand, course aggregates, or compacted dirt. The invention provides for mounting of the cutting blades at any of three angles by means of three sets of mounting holes that are provided in the runners. Likewise, U. S. Patent No. 5,397,200 to Seal provides for the adjustment of the angle between the blade and the earthen surface and adjustment of the depth of the blade with respect to the earthen surface, with the angular position and depth of the blade being fixed by bolts into the desired orientation. U. S. Patent No. 4,924,945 to Mork provides for adjustment of the depth of the blade by bolting and clamping, securing, or hydraulically locating the blade in various positions with respect to a horizontal plate that "floats" along the surface of the soil to control the depth of the blade. Finally, U. S. Patent No. 4,320,988 to Seal discloses the use of a hydraulic or a mechanical mechanism to alter the angular position and depth of a cutting blade.

All these prior spreader/graders share a common characteristic: they are designed for unidirectional operation. That is, the prior devices are configured to effectively work an earthen surface only in a single (either forward or aft) direction of travel. When a prior device is moved in the direction opposite its intended direction of travel, the prior device does not perform useful working of the earthen surface. In fact, when operated opposite its designed direction, a prior device will commonly damage the earthen surface because moving a blade of a spreader/grader

across a surface in the direction opposite its intended direction of travel results in gouging of the earthen surface.

Because prior devices are configured for unidirectional operation, when a prior device is used to grade an earthen surface, an operator must use the following methods to avoid damaging the worked earthen surface: maneuver the device in only one direction; or lift the device clear of the ground surface when maneuvering the device other than in its designed "forward" direction; or manually, mechanically, or hydraulically adjust the configuration of the blades on the device before moving the device across the earthen surface in the aft direction. These solutions result in unproductive use of the operator's time. Maneuvering a spreader/grader only in its designed "forward" direction is difficult or impossible at times. Lifting a spreader/grader off the earthen surface to avoid damaging the surface takes operator time, and the spreader/grader does not accomplish any working of the surface while it is above the earthen surface. Reconfiguring a spreader/grader upon each change of direction from forward motion to aft motion is troublesome and time-consuming for the operator. For many prior devices, reconfiguring the blades requires loosening and tightening multiple bolts. For others, reconfiguring the blades requires manipulation of a mechanical or a hydraulic apparatus; this operation requires both the time and the attention of the operator. In addition, prior mechanical or hydraulic devices that may be used in this fashion commonly are more complicated than the invention disclosed and claimed herein and thus are likely to be more difficult and expensive to build and to maintain.

BRIEF SUMMARY OF THE INVENTION

It is an object of this invention to provide a spreader/grader suitable for bi-directional operation in that it provides useful earth-working functions when propelled in either a forward or

an aft direction by a draft vehicle. It is another object of the invention to provide a device that may grade a surface in a forward direction and then begin grading the surface in an aft direction without adjustment of the spreader/grader by the operator.

To achieve these and other advantages and objects, and in accordance with the purpose of the invention as embodied and broadly described herein, in one aspect the inventor describes a spreader/grader having at least one pivoting moldboard and preferably more than one. Preferably the invention includes a frame comprising two vertical runners in fixed relation to one another and having at least one and preferably two or more blade supports disposed between the runners, with each blade support having a pivoting moldboard attached thereto. Preferably each pivoting moldboard has mounted thereon a pair of blades, including a blade facing generally forward and a blade facing generally aft. The parts of the device may be constructed of steel or other suitable material having sufficient strength and rigidity for this application. Suitable fastening methods include welding and bolting parts together. Suitable materials and methods of construction are known in the art.

The blades and moldboards preferably are so arranged that when forward motion is imparted to the spreader/grader by the draft vehicle, the motion of the spreader/grader and the interaction of the forward-facing blades with the earthen surface being worked cause the moldboards to pivot so that the forward-facing blades are in operative connection with the earthen surface being worked in an appropriate orientation for the earth-working function being performed, while the aft-facing blades are placed in a clearance position with respect to the earthen surface so as to avoid damage to the earthen surface. Preferably the moldboards and blades further are so configured that, when aft motion is imparted to the spreader/grader by the

draft vehicle, the interaction of the earthen surface and the aft-facing blades causes the moldboards to pivot so that the aft-facing blades are in operative connection with the earthen surface being worked in an appropriate orientation for the earth-working function being performed and the forward-facing blades are in a clearance position with respect to the earthen surface. In a preferred embodiment, the pivoting of the moldboards in response to forward or aft motion of the spreader/grader provides for bi-directional operation without the need for manual, mechanical, or hydraulic adjustment by the operator and with a reduced need for lifting of the device from the earthen surface to prevent damage to the surface. Optionally, the device may include adjustable means for arresting the pivotal motion of the pivoting moldboards such that the blade is in the appropriate angular position for the particular earth-working operation being performed. Further, in the preferred embodiment no operator intervention is required to properly orient the blades of the instant invention for forward or aft motion.

Both the foregoing general description and the following detailed description are exemplary and explanatory only and do not restrict the invention as claimed.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

Fig. 1 is a back view of an embodiment of the invention.

Fig. 2 is a top view of the embodiment depicted in Fig. 1.

Fig. 3 is a right side view of the embodiment depicted in Fig. 1.

Fig. 4 is a front view of the embodiment depicted in Fig. 1.

Fig. 5 is a left side view of the embodiment depicted in Fig. 1.

Fig. 6 is a sectional view of the embodiment depicted in Fig. 1, taken along lines A-A in Fig. 1.

Fig. 7 is a top view of an embodiment of pivoting moldboard 50 of the embodiment drawn in Fig. 1.

Fig. 8 is a rear view of the pivoting moldboard 50, which is shown in Fig. 7 (front view is identical).

Fig. 9 is an end sectional view of an embodiment of pivoting moldboard 50, which is shown in Fig. 7, taken along line B-B.

DETAILED DESCRIPTION OF THE INVENTION

The inventor now moves to a detailed description of the embodiment of the invention described in the drawings, where like parts are labeled with like reference numerals. In the embodiment depicted in the Figs. 1 through 6, spreader/grader 10 includes right side runner 12 having forward edge portion 13 and aft edge portion 15 and having shoe 16 attached thereto and left side runner 14 having forward edge portion 17 and aft edge portion 19 and having shoe 18 attached thereto. Disposed between side runners 12 and 14 and rigidly attached thereto are transverse frame members 20 and 22, which are mounted relatively high on side runners 12 and 14. Traverse frame members 20 and 22 have a square tubular structure and are welded at their ends to side runners 12 and 14. In a preferred embodiment, longitudinal frame members 24 and 26 are rigidly attached to aft transverse frame member 20 and forward transverse frame member 22 so as to provide additional rigidity to spreader/grader 10. Forward transverse frame member 22 has welded thereto five pairs of connector plates 70 and 72 having apertures 74 and 74B for connection of optional accessories such as scarifiers (not shown).

Spreader/grader 10 further includes a three-point hitch assembly for attaching the spreader/grader 10 to a draft vehicle. The three-point hitch assembly includes several elements.

Upper attachment points 28 and 30 are mounted on aft transverse frame member 20 and braced on longitudinal frame members 24 and 26, respectively. Right lower hitch plates 32 and 34 are rigidly attached to aft transverse frame member 20. Left lower hitch plates 36 and 38 also are rigidly attached to aft transverse frame member 20.

Aft blade support 40 and forward blade support 42 are disposed between side runners 12 and 14 and are rigidly attached thereto.

In the embodiment shown, forward blade support 42 and aft blade support 40 are essentially identical in both their structures and the structures of the pivoting moldboards attached thereto. Hence the inventor describes aft blade support 40 and the structures attached thereto, with the understanding that in this embodiment of the invention forward blade support 42 and its associated structures are essentially identical to those of aft blade support 40.

Aft blade support 40 has a tubular and essentially rectangular cross-section and is welded at its ends to side runners 12 and 14. Aft blade support 40 also has disposed along its length three slots 46A, 46B, and 46C capable of receiving a bolt or other fastener. Pivoting moldboard 50 is removably attached to aft blade support 40. Pivoting moldboard 50 has base 52 with three threaded anchors 54A, 54B, and 54C disposed along its length such that the threaded anchors may be aligned with and inserted into slots 46A, 46B, and 46C in order to removably attach pivoting moldboard 50 to aft blade support 40. Pivoting moldboard 50 is attached to aft moldboard 40 by inserting anchors 54A, 54B, and 54C into slots 46A, 46B, and 46C, respectively, and fastening bolts to threaded anchors 54A, 54B, and 54C. Pivoting moldboard 50 further has body 60 pivotally attached to base 52 by means of pin joint 62. Suitable joints are known in the art. Body 60 has two face plates 62 and 64, which extend nearly the length of aft

blade support 40 and have a plurality of apertures, one of which is designated 66A, thereon for mounting of generally forward-facing blade 70 and generally aft-facing blade 72 by conventional bolts.

In use, the embodiment of Figs. 1 through 9 is placed on the ground and connected to a draft vehicle's three point connection mechanism in conventional fashion by means of upper attachment points 28 and 30, right lower hitch plates 32 and 34, and left lower hitch plates 36 and 38. The three-point attachment mechanism of the draft vehicle may be used to raise spreader/grader 10 above the earthen surface to be worked or to lower spreader/grader 10 onto the earthen surface in conventional fashion for convenient operation—for example, to avoid grading of areas where no grading is desired.

After attachment to the draft vehicle, the spreader/grader 10 may be moved to the location of earth-working and then lowered onto the earthen surface to be worked. At this point in the operation, the spreader/grader 10 is ready for bi-directional grading. The draft vehicle may be used to move the spreader/grader 10 either forward or aft. When forward motion is imparted to the spreader/grader 10 by the draft vehicle, the interaction of the blades 70 and 72 with the earthen surface will cause the body 60 of the pivoting moldboard 50 to pivot so that the generally forward-facing blade 70 is placed in operative connection with the surface to be worked while the generally aft-facing blade 72 is placed in a clearance position with respect to the surface to be worked. On the other hand, when aft motion is imparted to the spreader/grader 10 by the draft vehicle, then the interaction of the blades 70 and 72 with the earthen surface causes the body 60 of the pivoting moldboard 50 to undergo pivotal motion so that the generally aft-facing blade 72 is placed in operative connection with the surface to be worked while the

generally forward-facing blade 70 is placed in a clearance position with respect to the surface to be worked.